

NH FISH AND GAME TROUT IN THE CLASSROOM (TIC)

Judy Tumosa, Watershed Education Specialist



Aquatic Resources Education (ARE) Program

- ❖ Federally Funded
- ❖ State Match = Teachers and Volunteers who provide Watershed Education in the classrooms
- ❖ Watershed Education Program (WEP)
- ❖ Watershed Ecology Institute (WEI)
- ❖ Let's Go Fishing (LGF)



Who Sponsors Trout in the Classroom?

- ❖ National Trout in the Classroom
- ❖ NH Fish and Game
 - ✓ Hatcheries and Fisheries Division
 - ✓ Watershed Education Program
- ❖ NH Trout Unlimited



TIC Mission is to Protect Watersheds and Brook Trout (EBT), a Species of Concern


NH Fish and Game's Mission

To conserve, manage, and protect wildlife, to educate the public about and to provide the public with ways to use and appreciate that wildlife.


Trout Unlimited's Mission

To conserve, protect and restore North America's cold water fisheries and their watersheds.





Trout in the Classroom is an environmental education program for students in grades K-12 to learn the importance of healthy watersheds

- ❖ Raise trout from eggs to fry, releasing them at the swim up stage in the local river/stream
 - ❖ Monitor tank water quality
 - ❖ Engage in stream habitat study
 - ❖ Learn to appreciate water resources
 - ❖ Grow to understand ecosystems
 - ❖ Begin to foster a conservation ethic
- 

Habitat Characteristics and Management of Brook Trout in New Hampshire



Physical Characteristics

Olive-green coloration with several yellow and blue spots

Males develop deep red coloration at spawning time

Male

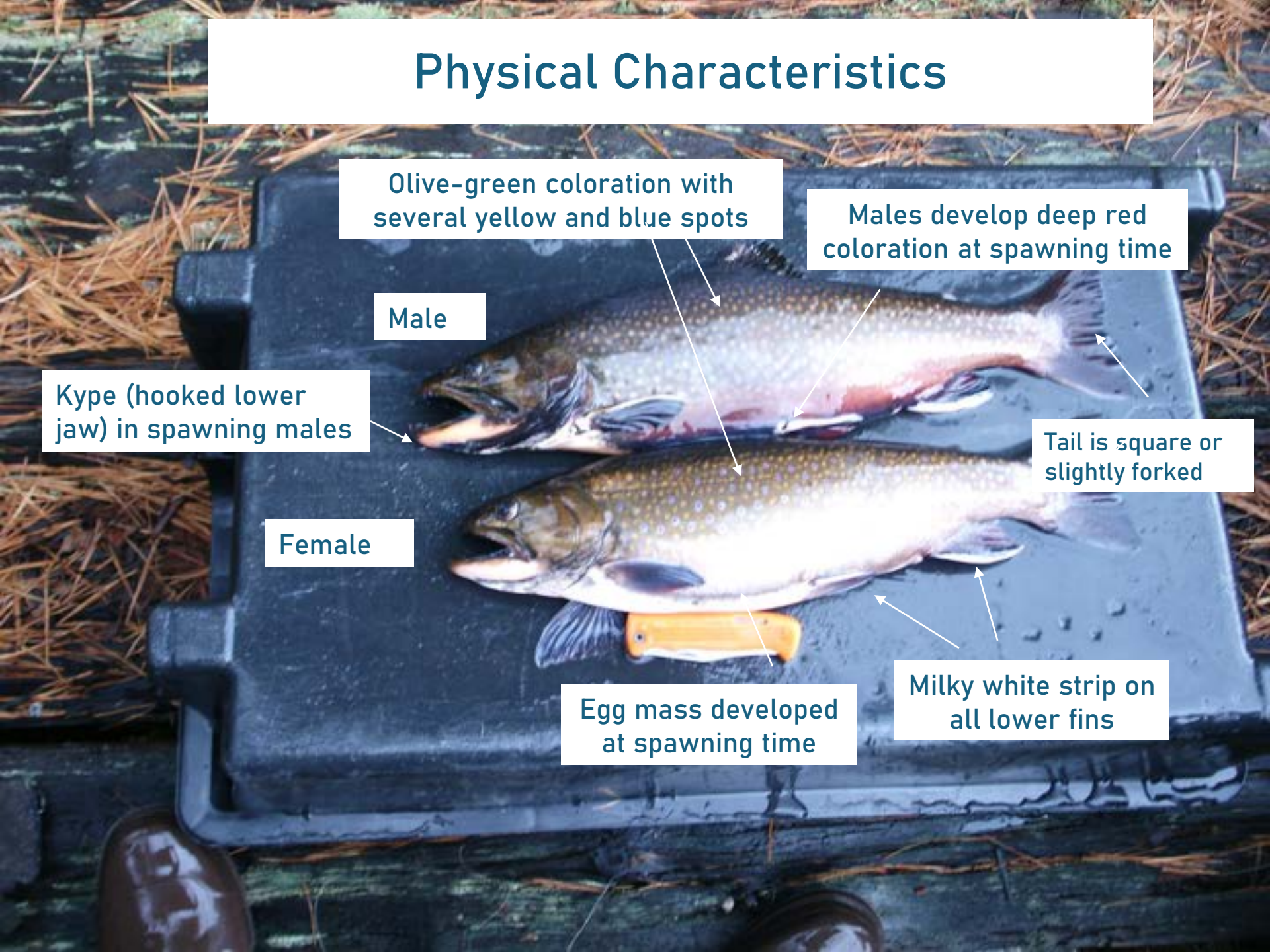
Kype (hooked lower jaw) in spawning males

Tail is square or slightly forked

Female

Egg mass developed at spawning time

Milky white strip on all lower fins





Maxilla

Pectoral Fins

Parr Marks

Dorsal Fin

Adipose Fin

Caudal/Tail Fin

Pelvic/Ventral Fins

Anal Fin



Habitat Requirements

- ❖ Well oxygenated and cold water
- ❖ Streambed material (substrate) can range from bedrock to mud. Sufficient areas of gravel are necessary for spawning.
- ❖ Opportunists, found from high gradient mountain streams to slow moving meadow brooks.
- ❖ Springs or cooler water temperatures below a summer thermocline are required for brook trout to inhabit lakes/ponds.

Food Sources

- ❖ Primarily feeds on all life stages of aquatic insects (e.g. stonefly, caddisfly, mayfly)
- ❖ Smaller trout will feed on zooplankton
- ❖ Other fish make up a small part of the diet



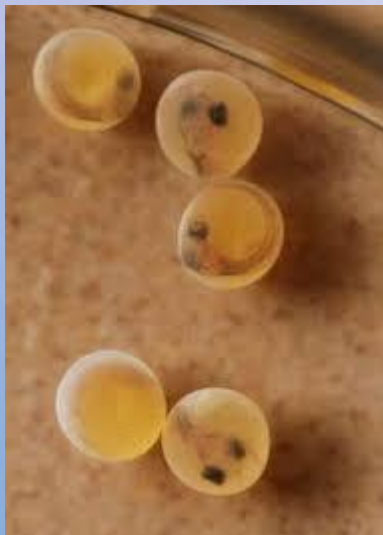
Spawning = Laying eggs

- ❖ Temperature driven
 - ✓ Wild fish-September thru October
 - ✓ Hatchery fish-November through early December
- ❖ Brook trout seek cooler, well oxygenated gravel substrate
- ❖ Females dig small nests called “redds”
- ❖ Eggs and milt are deposited together in the redd
- ❖ Very stressful to males and females



Life Cycle

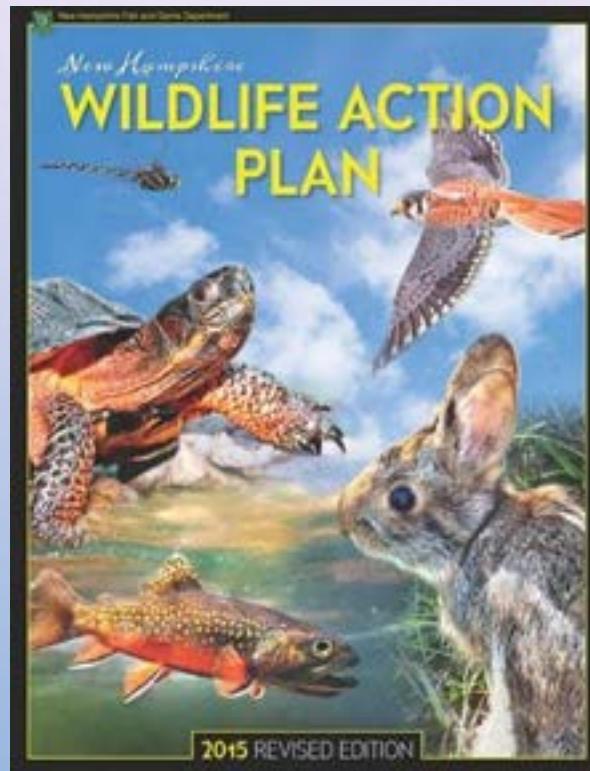
- ❖ After fertilization, development occurs inside the egg
- ❖ Once fully developed, the trout hatches (hatch time is temperature dependent)
- ❖ Newly hatched brook trout (sac fry/alevin) use their yolk sacs for food
- ❖ Upon yolk sac absorption, the brook trout fry swim up from the substrate in search of food and to establish territories
- ❖ Growth rates are significantly dependent on habitat characteristics (e.g. food availability, water temperature)



Why are we Concerned About Brook Trout?

Species of Concern in the NH Wildlife Action Plan (WAP)

<https://www.wildlife.state.nh.us/wildlife/wap.html>



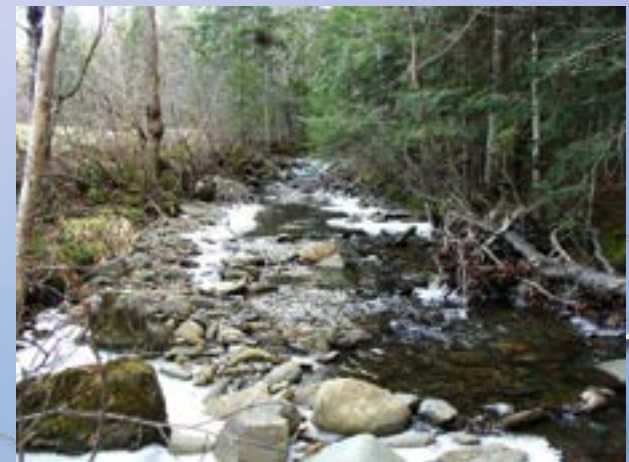
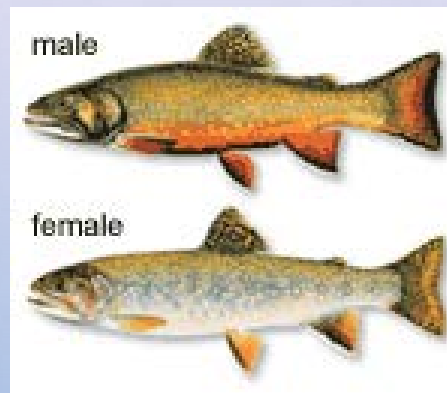
Extreme Storms and Flooding Impacts due to Climate Change

- ❖ Storms are less frequent & more severe, causing flooding
- ❖ Flooding increases the amount of pollutants and sediments that wash into streams
- ❖ Sediment can cover spawning areas for fish and smother macroinvertebrate populations



Extreme Storms and Flooding Impacts due to Climate Change (con't)

- ❖ Flooding alters stream flows and destroys stream crossings
- ❖ Watershed connectivity is interrupted, making it impossible for aquatic organisms (trout) to reach spawning grounds and cold water refugia



Rising Stream Temperatures Due To Climate Change

- ❖ Coldwater fish species (trout) cannot tolerate temperatures at and above 65 degrees F and water with less oxygen
 - ✓ If colder water access is cut off due to inadequate stream crossings, these species will be replaced by warm water fish species
 - ✓ Removing vegetation from riparian areas can also add to rising stream temperatures by removing shade, decreasing streambank stability, increasing sedimentation and pollution from runoff

Extreme Sedimentation and Erosion!!!



Acid Deposition

Primary Sources: Fossil fuel combustion and automobile exhaust

- ❖ Brook trout are very sensitive to pH fluctuations in water
- ❖ Mortality usually occurs when pH levels descend close to 5.0 (juvenile fish are even less tolerant)
- ❖ Most of New Hampshire's waters have poor acid buffering capacities (low levels of alkalinity)
- ❖ Acid rain can leech metals from the sediment further impacting brook trout
- ❖ Snow melt can deliver an acid shock to aquatic systems

How is NHF&G Managing Wild Brook Trout?

- ❖ Establish areas that support wild trout populations at sufficient densities
- ❖ Provide angling opportunities without sustaining or supplementing the fisheries with stocked trout
- ❖ Develop more restrictive regulations to protect the wild trout population



Eastern Brook Trout Joint Venture (EBTJV)

Partnership between state and federal agencies, regional and local governments, businesses, conservation organizations, academia, scientific societies, and private citizens working toward protecting, restoring and enhancing brook trout populations and their habitats across their native range.

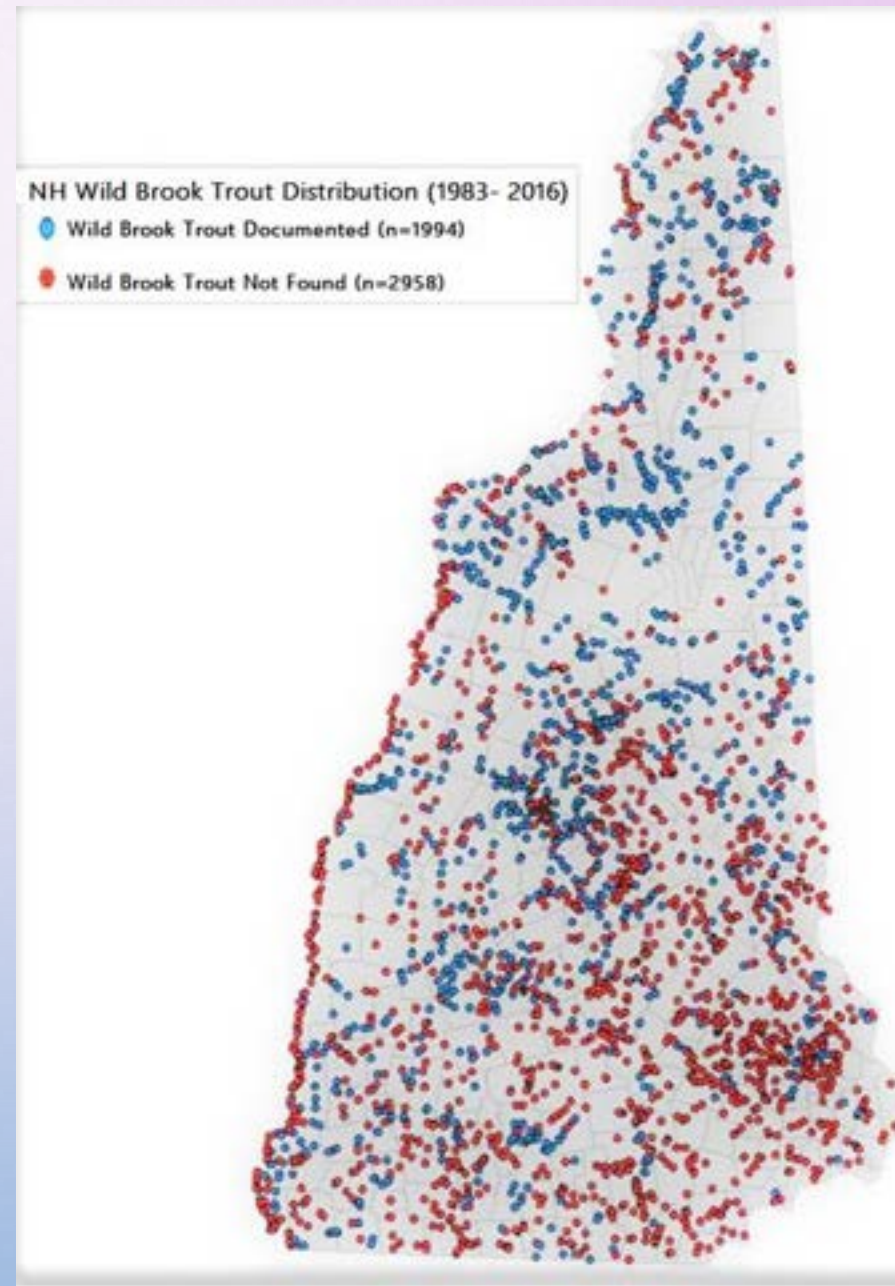


Survey Techniques For Brook Trout

- ❖ Backpack Electrofishing, with staff & community volunteers
- ❖ Netting
- ❖ Tagging
- ❖ Creel Surveys



Current Status and Distribution of Wild EBT 2016



Habitat Improvement



Streambank re-vegetation



Dam removal



Habitat enhancement/restoration



Crossing removal/replacement

How does NHF&G manage hatchery trout?



Purpose: To sustain or supplement recreational fishing opportunities in suitable waters.



NHFG annually stocks approximately 1 million brook, rainbow and/or brown trout into 318 lakes/ponds and 296 rivers/streams

Hatchery Techniques



Egg Taking



Egg Incubation



Egg Hatching



Fish Growth/ Holding

All Program Logistics can be found in the
[TIC Teacher's Manual](#)



Trout in the Classroom (TIC) Teacher's Manual

NH Fish and Game Watershed Education Program (WEP) and
New Hampshire Trout Unlimited (TU)

Developed 2011 (Revised 2019)

Sign up and Be Trained

- ❖ Fill out the TIC registration form – important points:
 - ✓ How are you using the program (watershed connection)
 - ✓ Where is your release site? (protect wild trout habitat)
- ❖ Attend a mandatory TIC workshop/webinar

Trout in the Classroom Registration Form

School Year Date:	
Teacher and School Information	
Teacher Name:	
Teacher Email:	
School Name:	
School Address:	
Phone:	
Will Attend Training? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Already did	
Classroom/Lab/Trainer	
Name:	
Email:	
Address:	
Will Attend Training? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Already did	
Student/Curriculum Information	
Grade:	Number of Students:
Subjects Covered:	
Primary Goal:	
Building/Releasing Information	
Chiller Status: <input type="checkbox"/> Owned <input type="checkbox"/> Borrowed <input type="checkbox"/> Need help getting one	
No. of Eggs Requested: <input type="checkbox"/> 100 <input type="checkbox"/> 200	No. of Tanks:
Proposed Release Site (River & Zip):	
Proposed Release Site (Latitude/Longitude; dec. degree):	
Return to Judy Tomosa, NH Fish & Game, 11 Hazen Drive, Concord, NH 03301 Phone: 603-271-0456, FAX 271-0456 Email: judy.l.tomosa@wildlife.nh.gov	



Trout-In-The-Classroom (TIC) Workshop Agenda
@ New Hampshire Fish & Game Headquarters
West Conference Room (End of the hall)
11 Hazen Drive, Concord
August 9, 2019 @ 9:00 to 12:00 pm

9:00 Registration - Welcome & Connections
9:10 **What is TIC?**
9:20 Eastern Brook Trout ecology and life cycle activity
9:40 Eastern Brook Trout Joint Venture/WAF species of concern
9:50 Tank Set-up, maintenance of eggs and tank
10:30 Break
10:40 Developmental Index
10:50 Permits & logistics of picking up your eggs
11:00 Teacher sharing, websites, TIC list serve, curriculum connections
Eastern Brook Trout Teacher Manual and Activity Guide
11:30 Water quality, macros, & maps for your release river
12:00 Final questions and migration Home.

Directions: <http://www.wildlife.state.nh.us/about/directions.html>
Contact: Judy Tomosa, NHFG Watershed Education Specialist
Work phone #271-0456, cell phone #953-5680
judy.l.tomosa@wildlife.nh.gov

Set up Your Tank

- ❖ 30 gallon tank is a typical size
- ❖ Water source must be free of chlorine or chloramine
 - ✓ Leave your tank water sitting it for 3 days to dissipate chlorine
 - ✓ Use a chemical from the pet store to treat the chloramine
- ❖ Trout are a cold water fish species and you are copying winter river temperatures so you need an aquarium chiller and insulation
 - ✓ Set up chiller at least a week +/- before eggs arrive
 - ✓ Set the chiller at the temperature of the river; 35-38° F range
 - ✓ We have community partners that may be able to help with a chiller [loan](#)
- ❖ Substrate can be rocks, bare bottom, aquarium gravel (rinse it!!!!)
- ❖ Other tank equipment includes filter, air stone, thermometer, turkey baster
- ❖ [Tank Set up Manual](#)
- ❖ [Tank set up video](#)

Completed Tank Set Up



Get Your Permit

- ❖ Permits are required for schools to have a live creature in their classroom
- ❖ Issued in January by the NHFG Fisheries Division before you get the eggs
- ❖ Post in a visible location by the tank



New Hampshire Fish and Game Department

HEADQUARTERS: 11 Hazen Drive, Concord, NH 03301-6500
(603) 271-3421
FAX (603) 271-1438

www.WildNH.com
e-mail: info@wildlife.nh.gov
TDD Access: Relay NH 1-800-735-2964

January 2, 2015

TO WHOM IT MAY CONCERN:

Under the authority contained in RSA 214:29, permission is hereby granted to **Joe Teacher, Pillsbury Crest Elementary School, 193 Raisin St., Wonderland, NH 03XXX, Tel. 603-555-5555**, to possess eggs and fry of brook trout in the classroom and to release fry into suitable stream habitat in Briney Brook, Wonderland.

Sub-permittees: Jeff Raspberry, Joan Strawberry

This permit, or a copy, shall be carried by the permittee while engaged in any activities allowed under this permit and shall be displayed to any Fish and Game conservation officer or employee upon request.

This permit shall expire December 31, 2015, unless sooner revoked or rescinded.

The permittee shall furnish the Executive Director with a written report on the disposition of all eggs and fry by January 31, 2016.

Glenn Normandeau
Executive Director

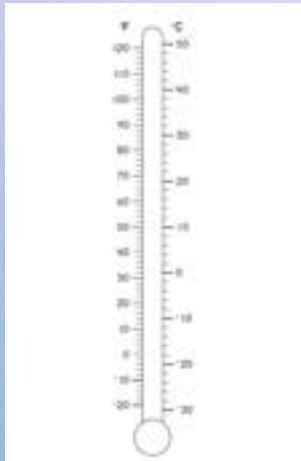
Pick Up Your Eggs

- ❖ You will receive notification when eggs are eyed up and ready
- ❖ Arrange pick up logistics with fellow teachers/parents/volunteers
- ❖ Contact the [hatchery](#) to let them know when you are picking up (Follow COVID protocols if appropriate)
- ❖ Ask the hatchery what their water temperature is and % development of the eggs
- ❖ Take a clean jar for the eggs and a cooler to keep them cool
- ❖ Travel to the hatchery
- ❖ Transport back to school and introduce to your tank; make sure water temperatures are no more than 3 degrees F difference



Maintain Your Tank

- ❖ Check temperature every day to make sure the chiller is working and to track egg development
- ❖ Remove white eggs – they are dead
- ❖ Do not introduce any dirt or chemicals into the tank
- ❖ Monitor the nitrogen cycle, pH, dissolved oxygen, especially after hatching



Track The Egg Development

- ❖ Eggs develop a certain % every day, based on the tank water temperature; warmer water, eggs develop faster
- ❖ Start with the % development provided to you by the hatchery staff = the amount that the eggs developed while in the hatchery
- ❖ Check the tank water temperature every day and figure out the % development using the chart (on the next slide)
- ❖ Add that % development cumulatively each day to track the egg development; 100% means it is time for them to swim up

Brook Trout Developmental Index

Prepared by Jason Smith Powder Mill Hatchery 3/13/08

Temp F	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
33	0.288	0.294	0.300	0.306	0.312	0.319	0.325	0.331	0.337	0.343
34	0.349	0.355	0.361	0.367	0.373	0.380	0.386	0.392	0.398	0.404
35	0.410	0.416	0.422	0.428	0.434	0.441	0.447	0.453	0.459	0.465
36	0.471	0.477	0.483	0.489	0.495	0.502	0.508	0.514	0.520	0.526
37	0.532	0.538	0.544	0.550	0.556	0.562	0.568	0.574	0.580	0.586
38	0.592	0.598	0.604	0.610	0.616	0.623	0.629	0.635	0.641	0.647
39	0.653	0.659	0.665	0.671	0.677	0.684	0.690	0.696	0.702	0.708
40	0.714	0.722	0.729	0.737	0.745	0.753	0.760	0.768	0.776	0.783
41	0.791	0.799	0.806	0.814	0.822	0.830	0.837	0.845	0.853	0.860
42	0.868	0.876	0.883	0.891	0.899	0.907	0.914	0.922	0.930	0.937
43	0.945	0.953	0.960	0.968	0.976	0.984	0.991	0.999	1.007	1.014
44	1.022	1.030	1.038	1.046	1.054	1.061	1.069	1.077	1.085	1.093
45	1.100	1.111	1.123	1.134	1.146	1.157	1.168	1.180	1.191	1.203
46	1.214	1.225	1.237	1.248	1.260	1.271	1.282	1.294	1.305	1.317
47	1.328	1.339	1.351	1.362	1.374	1.385	1.396	1.408	1.419	1.431
48	1.442	1.453	1.465	1.476	1.488	1.499	1.510	1.522	1.533	1.545
49	1.556	1.567	1.579	1.590	1.602	1.613	1.624	1.636	1.647	1.659
50	1.670	1.678	1.686	1.695	1.703	1.711	1.719	1.727	1.736	1.744
51	1.752	1.760	1.768	1.777	1.785	1.793	1.801	1.809	1.818	1.826
52	1.834	1.842	1.850	1.859	1.867	1.875	1.883	1.891	1.900	1.908
53	1.916	1.924	1.932	1.941	1.949	1.957	1.965	1.975	1.982	1.990
54	1.998	2.006	2.014	2.023	2.031	2.039	2.047	2.055	2.064	2.072
55	2.080									

This chart goes from fertilization to swim-up.

Using the chart above, if your tank water is 33.0 degrees F, the egg development for that day = 0.288%. At 33.1 degrees F, the development for that day = 0.294%. At 33.2 degrees, development for that day = 0.300%. Use these figures to track the overall development of your eggs. At 73%, most eggs should be hatched, at 100% they are ready for swim up and releasing. See page 18 of the [TIC Teacher's Manual](#) for more details.

cumulative % development
 weakly eyed 29%
 shocking 38-42%
 strongly eyed 47%
 Hatched 73%
 swim up 100%

Clean up at the end of the Year

❖ Clean the tank, chiller, filter

- ✓ Use a 1 part Chlorine bleach to 10 parts water solution to clean tank, substrate, and chiller coil – use SOFT brushes or cloths – let everything dry completely
- ✓ Remove dust and lint from all vents on the chiller using vacuum or soft cloth
- ✓ Clean filter based on manufacturer's recommendations and replace cartridges for next year

Complete Your Evaluation (Required by NHFG Executive Director)

Trout In The Classroom (TIC) Evaluation

School Year Date:	
Teacher and School Information	
Teacher Name:	
Teacher Email:	
School Name:	
Student/Curriculum Information	
Grade:	Number of Students:
Subjects Covered:	
Primary Goal:	
Raising/Releasing Information (Required by the NHFC Inland Fisheries Division)	
No. of Eggs Received:	No. of Trout Released:
Release Date:	Release Site:

Connections to the NHFG Watershed Education Program (WEP) objectives:

1. **Promoting Aquatic Habitat** – How did your students learn to recognize healthy habitat, and how to maintain it or improve it as needed?
2. **Understanding Watersheds** – How did your students learn to understand that watershed health is dependent on land use and water quality?
3. **Encouraging Community Involvement** – How did you grow community interest and involvement in natural resource stewardship?

Did you feel adequately trained? If not, how can we improve?

Were the curriculum materials useful? If not, how can we improve?

Was there adequate technical support? If not, how can we improve?

Do you want to participate in the NH Trout in the Classroom Program next year? Yes? No?

What additional training in aquatic topics would you like to see offered?

Any additional comments?

Return to Judy Timmon: NH Fish & Game, 11 Hazen Drive, Concord, NH 03301
Phone: 603-271-0436; FAX 271-0465 Email: judy.timmon@wildlife.nh.gov

THANK YOU for your interest in watershed education and keeping the fish and wildlife of the state healthy!

Additional Curriculum Resources

- ❖ NOTE: NHF&G WEP is designed for middle and high school so resources for those grades can be found on the WEP Curriculum Resources page:

<https://www.wildlife.state.nh.us/education/watershed-resources.html>

- ❖ For additional resources (including for Elementary Grades), check out
 - ✓ [National TIC website](#)
 - ✓ [NH TIC Activity Guide](#)
 - ✓ [NH Hatchery Activity Guide](#)
 - ✓ [NH TIC website](#) (hosted and maintained by a NH TIC teacher)
 - ✓ [NH TIC video](#)
 - ✓ [NH TIC Schools ArcGIS map \(2019-20\)](#)

Collect Data in Your Watershed

Water Quality Measurements: PH, Dissolved Oxygen, Temperature, Conductivity, Turbidity

[Water quality sampling instructions](#)

[Water quality data sheets](#)



Volunteer Biological Assessment Program (VBAP)

❖ Macroinvertebrate Sampling and Biotic Index Calculation based on Pollution Tolerance

❖ Stream Assessment

[VBAP Manual](#)

[VBAP video](#)



Watershed Assessment Using ArcGIS Online (AGO)

Click on the WEP Watershed Map to see data collected, shared and analyzed by NHFG and teachers and students in watersheds all over the state.

The screenshot displays the ArcGIS Online interface for a web map titled "A WEP Watershed Map". The map shows a green landscape with a yellow watershed boundary and a blue stream. A popup window is open over a point on the stream, displaying the following data:

WQ_WEP: 03-HAR	
Latitude	43.22
Longitude	-71.74
Site	03-HAR
Stream	Hardy Springs Brook
Town	Hopkinton
Volunteer	NHWE1
pH	6.15
DO	15.10
Temp_C	21.50
Temp_F	70.70
Conductivi	0.00
Turbidity	1.37
VEAP	3.16

The interface includes a search bar at the top right with the text "Find address or place", a "NEW MAP" button, and a user name "Judy". The left sidebar shows map details, including the title "A WEP Watershed Map", the creator "Web Map by jurnosa_nhwep", and the last modified date "September 6, 2013". The bottom of the page features the Esri logo and the text "POWERED BY esri".

How Can I Help My Watershed?

- ❖ Support watershed education in your community
 - ✓ Help implement the Water Education Plan
 - ✓ Take part in watershed congresses
- ❖ Teach local students - what is a conservation commission?
- ❖ Sponsor citizen science & intern opportunities
 - ✓ Invasive species inventories
 - ✓ Natural resource inventory/EBT studies
 - ✓ Riparian buffer establishment/maintenance
- ❖ Support a watershed/trout in the classroom school.
 - ✓ Be a liaison and egg deliverer
 - ✓ Fund tank and chiller supplies
 - ✓ Be a resource specialist to help with field days at the river
 - ✓ Provide resource studies and data

A Healthy Local Stream Is The Reward For Us All





Judy Tumosa, Watershed Education Specialist

NH Fish and Game Department

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